Journal of the Lepidopterists' Society
48(3), 1994, 199–204

FIELD OBSERVATIONS OF MATINGS BETWEEN FEMALE *LIMENITIS ARCHIPPUS* AND MALE *L. ARTHEMIS* SUBSPECIES (NYMPHALIDAE)

CHARLES V. COVELL, JR.
Department of Biology, University of Louisville, Kentucky 40292, USA

Abstract. Natural matings of female viceroy butterflies, *Limenitis archippus*, with males of *L. arthemis astyanax* in Kentucky and *L. arthemis arthemis* in Wisconsin are described and illustrated. These are the first field reports of female *L. archippus* paired with male *L. arthemis*. The interspecific pairing observed in Kentucky, plus the collection of two hybrid male "rubidus" Strecker at the same site in September 1980 and 1993 suggest a high level of hybridization at that site. This seemingly high frequency is discussed in light of recently advanced hypotheses.

Additional key words: *Limenitis arthemis arthemis, L. arthemis astyanax*, hybridization.

Natural hybridization among North American butterflies is apparently uncommon, except between *Colias eurytheme* and *C. philodice* (Silberglied 1973). However, hybridization recently has been observed with some frequency in the highly mimetic admiral butterflies *Limenitis archippus* (Cramer) and *L. arthemis* (Drury). The viceroy (*L. archippus*) has evolved appearance and behavior modeled after the monarch, *Danaus plexippus* (L.), and in Florida, the queen, *D. gilippus* (Cramer) (Ritland 1990). *Limenitis arthemis astyanax* is a Batesian mimic of the pipevine swallowtail, *Battus philenor* (L.) (Papilionidae), within the range of that swallowtail, grading northward to the non-mimetic, white-banded subspecies *L. arthemis arthemis*. Mimicry in these two eastern *Limenitis* species has been studied extensively in the laboratory (Platt & Brower 1968, Platt 1983). Platt et al. (1978) reported records of 10 wild-caught hybrids resulting from *L. archippus* × *L. arthemis arthemis*, known as "arthechippus" Scudder, and 24 "rubidus" Strecker—the F_1 hybrid of crosses between *L. archippus* and *L. arthemis astyanax*. Platt (1987) raised the number of both hybrids to 32, and Platt and Maudsley (1994) increase the number to 45. All known wild-caught hybrids are males.

Collections and Observations in Kentucky and Wisconsin

One of the records listed by Platt et al. (1978) was from Jefferson County, Kentucky, collected by R. Steilberg and J. Smith in September 1948. That specimen is apparently lost. Three additional specimens have been taken more recently in Kentucky, and are in the University of Louisville collection. The late Siegfried Scholz collected one of these at Waverly Park near Valley Station, Jefferson County, on 21 October 1978. I took another on the banks of the Mississippi River at Hickman,


2
4
1
3

Fulton County, Kentucky, on 14 September 1980. On 7 October 1989, at 1725 h, I encountered a nearly fresh female *L. archippus* mating with a ragged male *L. arthemis astyanax* (Fig. 1). This occurrence was only about 300 m south of the 1980 capture location. Robert V. Gregg also took a hybrid at the exact same site on 11 September 1993 (Figs. 3, 4).

Temperatures on the September capture dates in 1980 and 1993 were moderately high, and many pierids and other butterflies were recorded on those days. The day of the mating event in 1989 was cool, reaching a high of only about 17 degrees Celsius. Several other female viceroys were on bushes and trees nearby in basking postures. While not quantified, there were significantly more *L. archippus* than *L. arthemis astyanax* at the site. Abundant willow (*Salix* sp.; Salicaceae) was growing along the Mississippi River bank there, but I did not notice any *Prunus* species (Rosaceae). Very few butterflies of other species were still active.

The mating pair was photographed by W. R. Black, Jr., and we observed the phenomenon until 1740 h when I decided to capture the paired insects. As soon as I approached them with a net, the female flew upward, carrying her mate with her. After attaining a height of about 45 m, she descended into a small tree, barely within reach of my net. After capturing them I placed the pair in a Ziploc bag where they continued mating until dark, an hour later. I took them back to Louisville, but found them moribund next morning. The female could not oviposit because a dried fluid (presumably hemolymph) had covering the posterior part of her abdomen. I dissected out several of the eggs but none hatched.

In personal correspondence about this occurrence with A. P. Platt, I learned that this was the first field observation of a female *L. archippus* mating with a male *L. arthemis astyanax*. Later Platt informed me of a female viceroy seen mating with a male *L. arthemis arthemis* in Rusk County, Wisconsin (Fig. 2). In this case, photographs were taken by Steven Mertins of Ixonia, Wisconsin, after the discovery of the pair by his son Jake. The Mertins informed Platt that the mating was observed in "mid-afternoon" at the "end of August 1988." They did not collect the butterflies. This occurrence is the earliest record of a female *L. archippus* involved in interspecific mating. Platt et al. (1978) report

←

FIGS. 1–4. **1**, Female *L. archippus* mating with male *L. arthemis astyanax*, Hickman, Fulton County, Kentucky, 7 October 1989; **2**, Female *L. archippus* mating with male *L. arthemis arthemis*, Rusk County, Wisconsin, August 1988; **3**, Upperside of *L. archippus* × *L. arthemis astyanax* ("rubidus"), Hickman, Fulton County, Kentucky, 11 September 1993; **4**, Underside of specimen shown in 3.

three captures in Wisconsin of hybrid male "rubidus" with features similar to Kentucky specimens (Figs. 3, 4).

DISCUSSION

The apparent frequency of hybridization in *Limenitis* at the western Kentucky site may lend support to hypotheses proposed by Ritland (1990). He pointed out that while records of hybrid admirals are rare over most of their sympatric ranges, there were 7 "rubidus" recorded (2 seen or captured, and 5 reared from captured larvae) from a zone in southern Georgia to northern Florida during a 13-month period. Ritland also observed matings in nature between female *L. arthemis astyanax* and male *L. archippus* there. He indicates that these observations "provide evidence of mate-choice breakdown"—i.e., careless mate selection by *L. arthemis astyanax* females and consequent hybridization. This phenomenon may be more common in the southern Georgia/northern Florida area than elsewhere in their mutual ranges, as supported by additional evidence presented by Platt and Maudsley (1994). Ritland gives possible explanations as (1) more frequent matings between these species there than elsewhere, and (2) mating frequency not greater there, but F_1 hybrids "more viable than those elsewhere." Segregation of the species by habitat determined by different foodplants is mentioned as a means of pre-mating segregation. Ritland points out that in his study area, there is little wild cherry—the usual foodplant of the red-spotted purple—and that the larvae feed on willows alongside *L. archippus*. Platt and D. Flaim have observed the larvae of *L. arthemis* subspecies feeding on Salicaceae in Maryland and New England as well. Midsummer senescence of wild cherry leaves could lead to increased oviposition on willows by *L. arthemis astyanax* by midsummer females producing the southern fall brood. This explanation would not hold for the hybrids reported by Ritland (1990) and Platt and Maudsely (1994) that eclosed prior to August.

A third possible explanation is that the Georgia/Florida area represents an intergrade zone between the northern orange *L. archippus archippus* and the dark brownish Florida viceroy, *L. archippus floridensis* (Strecker) that mimics the queen, *Danaus gilippus* Cramer, instead of the monarch. In that area, normal mate selection behavior could be less discriminating, and *L. arthemis astyanax* may mate more readily with *L. archippus*.

Against this background, the observation of one interspecific mating and two specimens of "rubidus" within the space of about five riverine acres in western Kentucky seems to lend support to the following conditions mentioned by Ritland as characteristic of a "hybridization hot spot."

(1) Abundant willow but no black cherry were observed at the site (although black cherry could exist in some nearby woodland, subject to flooding as occurred in the summer of 1993).

(2) Many more *L. archippus* than *L. arthemis astyanax* were seen at the site on each visit in September or October. The viceroy outnumbered the red-spotted purple on 11 September 1993 by a ratio of 10:1 (W. R. Black, Jr. pers. comm.).

The first observation seems to qualify as what Ritland (pers. comm.) calls the "unusual habitat explanation." With respect to probable use of willow as a larval foodplant by both species, the Fulton County, Kentucky site seems to match parts of the Georgia/Florida hybridization zone. Perhaps *L. arthemis astyanax* that mate successfully with *L. archippus* in the Kentucky site fed as larvae on willow rather than wild cherry. If so, pheromones of the two species might be more similar and isolating mechanisms diminished than if *L. arthemis astyanax* fed on wild cherry. In September and October very few *L. arthemis astyanax* were seen at that site, while the viceroy was common. Male *L. arthemis astyanax* might court female *L. archippus* in the absence of sufficient females of their own species.

Less applicable to the Kentucky case is Ritland's hypothesis that a higher rate of interspecific interaction might occur where viceroy wing color is unstable, as in the Georgia/Florida sites described by Ritland and by Platt and Maudsley (1994). Platt indicates viceroys with the contrastingly dark forewings can be found as far north as the Great Dismal Swamp on Virginia's coastal plain. I have found very few individuals with forewings darker than hindwings in Fulton County, Kentucky, and none with red spots on the underside as mentioned by Platt and Maudsley (1994).

I cannot affirm that the frequency of hybridization between the two admiral species in Fulton County, Kentucky, approaches that reported from the Georgia/Florida habitat. However, three observations of such activity during a total of less than 12 hours of observation (1980–1993) over several seasons seems to indicate rather high frequency there.

Platt et al. (1978) mention the prevalence of hybrid admirals occurring in late summer to early fall—toward the end of the flight season northward. The Kentucky observations and collections support that observation.

My observations in Kentucky lead me to agree with Ritland (1990: 171): "These arguments remain speculative because mate choice in viceroys and red-spotted purples is poorly understood; however, the proposed mechanisms identify several avenues of research that should be pursued in attempting to explain the elevated hybridization in this area." The definition of hybridization "hot spot" should emerge as more field data are collected and assimilated.

ACKNOWLEDGMENTS

I thank A. P. Platt for providing the Wisconsin data and photos, and for his helpful comments. Thanks are due also to Jake and Steve Mertins for providing their color photograph from Wisconsin; to R. V. Gregg for donating his "rubidus" specimen to the University of Louisville Insect Collection; and to W. R. Black, Jr., and Scouts of Troop 1, Paducah, Kentucky, for their assistance. My thanks also to L. P. Brower and D. Ritland for comments on the manuscript.

LITERATURE CITED

PLATT, A. P. 1983. Evolution of North America admiral butterflies. Bull. Entomol. Soc. Am. 29:10–22.

———. 1987. Recent observations of North American admirals (Lepidoptera: Nymphalidae). Maryland Entomol. 3:18–20.

PLATT, A. P. & L. P. BROWER. 1968. Mimetic versus disruptive coloration in intergrading populations of *Limenitis arthemis* and *astyanax* butterflies. Evolution 22:699–718.

PLATT, A. P. & J. R. MAUDSLEY. 1994. Continued interspecific hybridization between *Limenitis* (*Basilarchia*) *arthemis astyanax* and *L. archippus* in the southeastern U.S. (Nymphalidae). J. Lepid. Soc. 48:190–198.

PLATT, A. P., G. W. RAWSON & G. BALOGH. 1978. Interspecific hybridization between *Limenitis arthemis astyanax* and *L. archippus* (Nymphalidae). J. Lepid. Soc. 32: 289–303.

SILBERGLIED, R. E. 1973. Ultraviolet differences between the sulfur butterflies, *Colias eurytheme* and *C. philodice*, and a possible isolating mechanism. Nature 241:406–408.

RITLAND, D. B. 1990. Localized interspecific hybridization between mimetic *Limenitis* butterflies (Nymphalidae) in Florida. J. Lepid. Soc. 44:163–173.

Received for publication 25 October 1993; revised and accepted 19 April 1994.